U.S. DEPARTMENT OF COMMERCE, PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

33806W005
Customer No. 00441

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)
10/009467

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP00/03993	**04 May 2000**	**17 June 1999**

TITLE OF INVENTION	**An Acid Bath for the Electrodeposition of Glossy Gold and Gold Alloy Layers and a Gloss Additive for Same**
APPLICANT(S) FOR DO/EO/US	**Uwe MANZ and Klaus BRONDER**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.

2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.

3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l).

4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau) **(see 16 e)**.
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).

6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).

7. ☒ Amendments to the claims of the International Application under PCT Article 34 (35 U.S.C. 371).
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.

8. ☐ A translation of the amendments to the claims under PCT Article 34 (35 U.S.C. 371).

9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.

12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. ☒ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.

14. ☐ A substitute specification.

15. ☐ A change of power of attorney and/or address letter.

16. ☒ Other items or information:

a. PCT/RO/105 (in German);
b. PCT/IB/306 (dated April 27, 2001);
c. PCT/IB/306 (dated August 29, 2001);
d. PCT/IPEA/416 and PCT/IPEA/409 (in German); and
e. Copy of WO 00/79031 and International Search Report (PCT/ISA/210) (in German and English) (attached to Information Disclosure Statement).

(Page 2) U.S. DEPARTMENT OF COMMERCE/ PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES
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17. ☒ The following fees are submitted:

	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)): Search Report has been prepared by the EPO or JPO **$890.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.482) $710.00		
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2) $740.00		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... $ 1,040.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) $100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$890.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.495(c)).	$ ---	

Claims	Number Filed	Number Extra	Rate		
Total Claims	6 -20 =	0	x $18.00	---	
Independent Claims	2 - 3 =	0	x $84.00	---	
Multiple dependent claim(s) (if applicable)			+ $280.00	---	
			TOTAL OF ABOVE CALCULATIONS =	$ 890.00	
Reduction by ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).				---	
			SUBTOTAL =	$ 890.00	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				---	
			TOTAL NATIONAL FEE =	890.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property. +				---	
			TOTAL FEES ENCLOSED =	890.00	
				Amount to be refunded	$
				charged	$

a. ☒ A check in the amount of $ 890.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $____ to cover the above fees.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-4300.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

SMITH, GAMBRELL & RUSSELL, LLP

SIGNATURE

Robert G. Weilacher 20,531
NAME REGISTRATION NO.

1850 M Street, N.W., Suite 800,
Washington, D.C. 20036
Telephone: (202) 659-2811
Facsimile: (202) 263-4329

Date: December 14, 2001

Atty. Dkt No.
33806W005

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Uwe MANZ, et al.

International PCT Application No.: PCT/EP00/03993

International Filing Date: May 4, 2000

U.S. Serial No.: To Be Assigned — Group Art Unit: To Be Assigned

Filed: December 14, 2001 (Herewith) — Examiner: To Be Assigned

For: AN ACID BATH FOR THE ELECTRODEPOSITION OF GLOSSY GOLD AND GOLD ALLOY LAYERS AND A GLOSS ADDITIVE FOR SAME

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to or concurrent with calculation of the filing fees, please amend the claims (as earlier amended during the Preliminary Examination Stage and accompanying the Preliminary Examination Report) as follows.

IN THE CLAIMS:

Applicants have attached to this Amendment documents entitled "Amended Claims" and "Marked-Up Copy of Previous Claims". Please replace claims 3 - 4 and 6 with amended claims 3 - 4 and 6 as shown in the document entitled "Amended Claims".

Atty. Docket No.
33806W005

REMARKS

Entry and consideration of this Preliminary Amendment is respectfully requested prior to or concurrent with calculation of the filing fees. This Preliminary Amendment is being filed to remove the multiple dependent claims to avoid the surcharge.

Examination on the merits is awaited.

Respectfully submitted,
SMITH, GAMBRELL & RUSSELL, LLP

By: _____

Robert G. Weilacher, Reg. No. 20,531
1850 M Street, N.W., Suite 800
Washington, D.C. 20036
Telephone: (202) 659-2811
Fax: (202) 263-4329

Dated: December 14, 2001

Marked-Up Copy of Previous Claims 3-4 and 6

3. (Amended) An electrodeposition bath according to Claim 1 [or 2], characterised in that, it contains, as a further gloss additive, the compounds pentyl sulfonate, hexyl sulfonate, heptyl sulfonate, octyl sulfonate, nonyl sulfonate, decyl sulfonate, dodecyl sulfonate, cyclohexyl sulfonate, pentyl sulfate, hexyl sulfate, heptyl sulfate, octyl sulfate, nonyl sulfate, decyl sulfate, dodecyl sulfate, cyclohexyl sulfate or their isomers.

4. (Amended) An electrodeposition bath according to Claim 1 [Claims 1 to 3], characterised in that, it contains 0.01 to 10 g/l, preferably 0.1 to 5 g/l, of a compound of the formula I.

6. (Amended) A process for the electrodeposition of glossy gold and gold alloy layers, characterised in that, deposition takes place from a bath in accordance with Claim 1 [Claims 1 to 4] at a pH in the range 3 to 6, preferably 4 to 5.

Amended Claims 3-4 and 6

3. An electrodeposition bath according to Claim 1, characterised in that, it contains, as a further gloss additive, the compounds pentyl sulfonate, hexyl sulfonate, heptyl sulfonate, octyl sulfonate, nonyl sulfonate, decyl sulfonate, dodecyl sulfonate, cyclohexyl sulfonate, pentyl sulfate, hexyl sulfate, heptyl sulfate, octyl sulfate, nonyl sulfate, decyl sulfate, dodecyl sulfate, cyclohexyl sulfate or their isomers.

4. An electrodeposition bath according to Claim 1, characterised in that, it contains 0.01 to 10 g/l, preferably 0.1 to 5 g/l, of a compound of the formula I.

6. A process for the electrodeposition of glossy gold and gold alloy layers, characterised in that, deposition takes place from a bath in accordance with Claim 1 at a pH in the range 3 to 6, preferably 4 to 5.

An acid bath for the electrodeposition of glossy gold and gold alloy layers and a gloss additive for same

Description:

The invention provides an acid bath for the electrodeposition of glossy gold and gold alloy layers and a gloss additive for same.

Electroplating gold baths usually contain gold and optionally one or more alloy elements in dissolved form.

These types of electrolytes are mainly based on gold cyanide complexes. It is necessary to adjust these electrolytes to a weakly to moderately acid pH by using inorganic and/or organic acids and buffer salts.

So that glossy gold or gold alloy layers are deposited from such baths, these usually contain specific inorganic or organic compounds as so-called "gloss additives".

A typical, very frequently used gloss additive is, as described for example in DE 23 55 581, the compound pyridine-3-sulfonic acid.

These types of additive shift or extend the working range which can be used, that is the range of current densities within which a glossy gold coating is deposited, in the direction of higher current densities. There again, the use of higher current densities enables deposition to proceed at a greater rate.

On the other hand, the working range of these types of gold baths also depends on the pH of the electrolytes. This means that if the pH is higher the working range (current density range which can be used) becomes narrower, but at the same time the current efficiency, and thus the rate of deposition, is increased.

Therefore, the object of the invention was to optimise the working conditions and deposition performance in these types of gold baths in such a way that on the one hand a maximum current density/working range is produced with the smallest possible negative effect when the pH is changed and on the other hand a maximum current efficiency and rate of deposition is achieved.

Surprisingly, it has now been found that this can be achieved if at least one compound of the general formula I is added as a further gloss additive to these types of baths for deposition of glossy gold layers,

$$R - SO_m - H \qquad (I)$$

wherein

m is the number 3 or 4, and

R represents a straight-chain or branched or cyclic alkyl group with up to 20 carbon atoms and, in the event that m = 4, also an aryl or heteroaryl group with up to 10 carbon atoms, which may be optionally substituted once or several times with straight-chain or branched alkyl groups with 1 to 14 carbon atoms.

Thus, the invention provides an acid bath for the electrodeposition of glossy gold and gold alloy layers containing gold and optionally one or more alloy elements in dissolved form and also at least one organic compound as a gloss additive, characterised in that the bath contains, as a further gloss additive, at least one compound of the general formula

$$R - SO_m - H \qquad (I)$$

wherein

m is the number 3 or 4, and

R represents a straight-chain or branched or cyclic alkyl group with up to 20 carbon atoms and, in the event that m = 4, also an aryl or heteroaryl group with up to 10 carbon atoms, which may be optionally substituted once or several times with straight-chain or branched alkyl groups with 1 to 14 carbon atoms.

Gloss additives in accordance with formula I are chosen from the classes consisting of alkyl sulfonates and alkyl, aryl or heteroaryl sulfates. In formula I, if m is the number 3 or 4 then R represents a straight-chain or branched or cyclic alkyl group with up to 20 carbon atoms. If m is the number 4 than R may also represent an aryl or heteroaryl group with up to 10 carbon atoms, wherein these may be substituted once or several times with straight-chain or branched alkyl groups with 1 to 14 carbon atoms.

Compounds of the formula I are known per se and are either commercially available or can easily be prepared by standard processes.

These compounds are sufficiently soluble in water and are compatible with the electrodeposition bath. The compounds have surfactant properties, wherein the corresponding effect is reduced when the total number of carbon atoms is less than 4 and generally sufficient solubility is no longer exhibited when the total number of carbon atoms is greater than 20.

Preferred gloss additives are compounds of the formula I in which R represents straight-chain or branched or cyclic alkyl groups with 5 to 12 carbon atoms and in particular for branched alkyl groups with 6 to 10 carbon atoms.

Typical gloss additives according to the invention are

pentyl sulfonate	pentyl sulfate
hexyl sulfonate	hexyl sulfate
heptyl sulfonate	heptyl sulfate
octyl sulfonate	octyl sulfate
nonyl sulfonate	nonyl sulfate
decyl sulfonate	decyl sulfate
dodecyl sulfonate	dodecyl sulfate
cyclohexyl sulfonate	cyclohexyl sulfate

and their isomers.

These compounds may also be present in the form of their salts.

Branched and short-chain compounds are particularly suitable due to their low tendency to pronounced foam production, in particular in processes and plant in which severe foam production could cause problems, e.g. in the case of air-stirred electrolytes, when processing in drums, in plants for high-speed deposition (spray plants) and in plants for selective deposition such as e.g. dipping cells.

The use of the further gloss additive according to the invention in acid baths for the electrodeposition of glossy gold and gold alloy layers expediently takes place in the concentration range from 0.01 to 10 g/l. Baths according to the invention which contain the gloss additive in accordance with formula I at a concentration of 0.1 to 5 g/l are particularly advantageous.

Due to the use according to the invention of compounds of compounds (sic) of the formula I as a further gloss additive in electrodeposition gold baths with an otherwise conventional composition, the current density/working

range which can be used is considerably extended in an unexpected manner and at the same time the current efficiency and the deposition performance are sometimes drastically increased.

To prepare gold baths according to the invention, many commonly used and commercially available weakly acidic gold baths may be used as the starting composition to which a corresponding amount of the compound of the formula I is added. The qualitative and quantitative composition of these types of gold baths is extremely well-known to a person skilled in the art from literature and from practice and therefore does not require a detailed explanation. In every case, these contain gold in dissolved form, obtained from gold salts or gold complex salts, wherein mainly gold cyanide complexes are used. Furthermore, the baths may contain alloy elements in the form of dissolved salts or complex salts. Furthermore, the baths contain inorganic and/or organic acids, corresponding salts and optionally buffer and supporting electrolytes in order to adjust the pH and the conductivity. In order to deposit glossy, smooth gold layers, organic compounds are generally contained therein, these mostly having surfactant properties and acting as a gloss-producer. A typical and well-proven gloss-producer of this type is pyridine-3-sulfonic acid.

Furthermore, the following compounds and their salts and derivatives are also suitable as conventional gloss additives:

nicotinic acid

nicotinamide

3-(3-pyridyl)-acrylic acid

3-(4-imidazolyl)-acrylic acid

3-pyridylhydroxymethanesulfonic acid

pyridine

picoline

quinolinesulfonic acid

3-aminopyridine

2,3-diaminopyridine

2,3-di-(2-pyridyl)-pyrazine

2-(pyridyl)-4-ethansulfonic acid

1-(3-sulfopropyl)-pyridinium betaine

1-(3-sulfopropyl)-isoquinolinium betaine

Electrodeposition gold baths according to the invention typically contain about

0.1 - 50 g/l of gold as a gold cyanide complex

0 - 50 g/l of alloy elements such as iron, cobalt, nickel, indium, silver, copper, cadmium, tin, zinc, bismuth, arsenic, antimony as a salt or complex salt

10- 200 g/l of citric acid/citrate as a buffer and/or supporting electrolyte

0.1 - 10 g/l of pyridine-3-sulfonic acid as gloss-producer

0.1 - 5 g/l of a compound of the formula I as a further gloss additive according to the invention,

wherein the pH of the bath is adjusted to 3 to 6, preferably 4 to 5.

Use of the gloss additive according to the invention produces a number of practical advantages. Thus, under otherwise unchanged conditions, the deposition performance can be clearly increased. Due to the wider working range, fine adjustment of the mode of operation is less critical, wherein the risk of defective deposition is greatly reduced.

However, a higher pH may also be used with an unchanged working range. The deposition performance can also be increased in this way.

Alternatively, however, a smaller gold concentration may be used while retaining the same deposition performance. The advantages associated with this move are the smaller losses due to electrolytes being carried over by adhering to the goods and the smaller amount of capital which is tied up.

Example 1:

A working range of up to 3 A/dm^2 is produced with a cell current of 2 A in a coating cell which contains a gold/cobalt electrolyte containing

10 g/l of gold in the form of potassium gold(I) cyanide
0.5 g of cobalt as cobalt sulfate
100 g/l of citric acid
3 g/l of pyridine-3-sulfonic acid.

adjusted to pH 4.2 with potassium hydroxide,

(trial conditions: platinised titanium anode, temperature 50°C, time 2 min, agitated at 500 rpm with a 25 mm magnetic stirring rod). The current efficiency at 3 A/dm^2 is 48 %; the rate of deposition is 0.98 µm/min.

By adding 1 g/l of nonyl sulfate, the maximum current density which can be used is increased to more than 5 A/dm^2. This corresponds to extending the working range by more than 66 %.

If the pH is then raised to 4.4, a working range of up to 4 A/dm^2 is produced; the deposition performance is 1.05 µm/min.

At a pH of 4.6 the working range extends up to 3 A/dm^2 and a rate of deposition of 1.15 µm/min is produced.

Example 2:

A maximum current density of 3 A/dm^2 is achieved in a gold/nickel electrolyte containing

10 g/l of gold in the form of potassium gold(I) cyanide
0.7 g of nickel in the form of nickel sulfate
100 g/l of citric acid
3 g/l of pyridine-3-sulfonic acid,
adjusted to pH 4.2 with potassium hydroxide,

on pre-nickel-coated sheets with the dimensions 25 x 40 mm (trial conditions: 1 litre glass beaker, platinised titanium anode, bath agitated at 200 rpm using a 60 mm magnetic stirring rod, goods moved at 5 cm/s). The cathodic current efficiency at 3 A/dm^2 is 52 % and the rate of deposition is 1.0 µm/min.

By adding 0.5 g/l of decyl sulfate, the maximum current density which can be used is increased to more than 7 A/dm^2. At 7 A/dm^2 the current efficiency is still 26 %, the deposition performance increases to 1.18 µm/min. This corresponds to increasing the rate by 18 %.

Example 3:

A maximum current density of 5 A/dm^2 is achieved in a gold/iron electrolyte containing

10 g/l of gold in the form of potassium gold(I) cyanide
0.05 g of iron as iron (III) citrate
100 g/l of citric acid
3 g/l of pyridine-3-sulfonic acid,
adjusted to pH 4.2 with potassium hydroxide,

on sheets with the dimensions 25 x 40 mm (for conditions, see example 2). The cathodic current efficiency is 31 % and the rate of deposition is 1.0 µm/min.

By adding 4 g/l of hexyl sulfate the maximum current density which can be used is increased to more than 6 A/dm^2. At 6 A/dm^2 the current efficiency is still 30 %; the deposition performance increases to 1.16 µm/min. This corresponds to increasing the rate by 16 %.

Example 4:

A working range of up to 5 A/dm^2 is produced in a coating cell with a cell current of 2 A in a gold/cobalt electrolyte containing

10 g/l of gold in the form of potassium gold(I) cyanide
0.5 g of cobalt as cobalt sulfate
100 g/l of citric acid

1 g/l 3-(3-pyridyl)-acrylic acid,
adjusted to pH 4.2 with potassium hydroxide,

(trial conditions: platinised titanium anode, temperature 50°C, time 2 min, agitated at 500 rpm with a 25 mm magnetic stirring rod). The current efficiency at 5 A/dm^2 is 26 %; the rate of deposition is 0.83 µm/min.

By adding 1.5 g/l of octyl sulfate the maximum current density which can be used is increased to more than 8 A/dm^2. At 8 A/dm^2 the current efficiency is still 19 %; the deposition performance increases to 1.0 µm/min.

Example 5:

In the gold/cobalt electrolyte from example 1, the maximum current density which can be used is increased to more than 5 A/dm^2 by adding 1 g/l of hexyl sulfonate. At 5 A/dm^2 the current efficiency is 35.1 %, the deposition performance is increased to 1.13 µm/min. This corresponds to increasing the rate by 15 %.

Example 6:

In the gold/cobalt electrolyte from example 1, the maximum current density which can be used is increased to more than 7 A/dm^2 by adding 1 g/l of octyl sulfonate At 7 A/dm^2 the current efficiency is 26.2 %, the deposition performance increases to 1.18 µm/min. This corresponds to increasing the rate by 20 %.

Example 7: Comparison example

In a gold/cobalt electrolyte (see example 1) consisting of

10 g/l of gold in the form of potassium gold(I) cyanide
0.5 g of cobalt as cobalt sulfate
100 g/l of citric acid,
adjusted to pH 4.2 with potassium hydroxide,

and using the trial conditions in example 1, the effect on the working range and the rate of deposition was determined when adding only octyl sulfate, only pyridine-3-sulfonic acid and both substances together as a gloss additive. The results are given in table 1.

The combination of the two substances greatly extends the working range and causes a considerable increase in the rate of deposition.

Table 1:

Octyl sulfate	Pyridine-3-sulfonic acid	Working range (gloss) up to	Rate of deposition
-	-	2 A/dm²	0.63 µm/min
2 g/l	-	2 A/dm²	0.65 µm/min
-	3 g/l	3 A/dm²	0.98 µm/min
2 g/l	3 g/l	5 A/dm²	1.12 µm/min

An acid bath for the electrodeposition of glossy gold and gold alloy layers and a gloss additive for same

Claims:

1. An acid bath for the electrodeposition of glossy gold and gold alloy layers, containing gold and optionally one or more alloy elements in dissolved form and also at least one organic compound as a gloss additive, characterised in that, the bath contains, as a further gloss additive, at least one compound of the general formula

$$\mathbf{R - SO_m - H} \qquad \text{(I)}$$

in which

m is the number 3 or 4

R represents a straight-chain or branched or cyclic alkyl group with up to 20 carbon atoms and, in the event that m = 4, also an aryl or heteroaryl group with up to 10 carbon atoms, which may be optionally substituted once or several times with straight-chain or branched alkyl groups with 1 to 14 carbon atoms.

2. An electrodeposition bath according to Claim 1, characterised in that, it contains, as a further gloss additive, at least one compound of the formula I in which **R** is a straight-chain or branched alkyl group with 5 to 12 carbon atoms, preferably a branched alkyl group with 6 to 10

carbon atoms.

3. An electrodeposition bath according to Claim 1 or 2, characterised in that, it contains, as a further gloss additive, the compounds pentyl sulfonate, hexyl sulfonate, heptyl sulfonate, octyl sulfonate, nonyl sulfonate, decyl sulfonate, dodecyl sulfonate, cyclohexyl sulfonate, pentyl sulfate, hexyl sulfate, heptyl sulfate, octyl sulfate, nonyl sulfate, decyl sulfate, dodecyl sulfate, cyclohexyl sulfate or their isomers.

4. An electrodeposition bath according to Claims 1 to 3, characterised in that, it contains 0.01 to 10 g/l, preferably 0.1 to 5 g/l, of a compound of the formula I.

5. Use of compounds of the general formula

$$R - SO_m - H \qquad (I)$$

in which

m is the number 3 or 4 and

R represents a straight-chain or branched or cyclic alkyl group with up to 20 carbon atoms and, in the event that m = 4, also an aryl or heteroaryl group with up to 10 carbon atoms, which may be optionally substituted once or several times with straight-chain or branched alkyl groups with 1 to 14 carbon atoms.

as further gloss additives in acid baths for the electrodeposition of glossy gold and gold alloy layers containing gold and optionally one or more alloy

elements in the dissolved form and also at least one organic compound as a gloss additive.

6. A process for the electrodeposition of glossy gold and gold alloy layers,
characterised in that,
deposition takes place from a bath in accordance with Claims 1 to 4 at a pH in the range 3 to 6, preferably 4 to 5.

An acid bath for the electrodeposition of glossy gold and gold alloy layers and a gloss additive for same

Abstract:

The invention provides an acid bath for the electrodeposition of glossy gold and gold alloy layers and a gloss additive for same.

By using compounds of the formula I

$$R - SO_m - H \qquad (I)$$

in which

m is the number 3 or 4 and

R represents a straight-chain or branched or cyclic alkyl group with up to 20 carbon atoms and, in the event that m = 4, also an aryl or heteroaryl group with up to 10 carbon atoms, which may be optionally substituted once or several times with straight-chain or branched alkyl groups with 1 to 14 carbon atoms,

as a further gloss additive, the current density/working range is extended with a small negative effect when the pH is changed and the current efficiency and deposition performance is increased.

UNITED STATES
Patents and Design Patents
Sole & Joint Inventors
Convention & Non-convention
PCT & Non-PCT
This form cannot be amended, altered or changed after it is signed.
(For use only for inventors who (if understand the English language.)

Declaration and Power of Attorney
United States Patent Application

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name.
I believe I am the original, first and sole inventor *(if only one name is listed below)* or an original, first and joint inventor *plural names are listed below)* of the subject matter which is claimed and for which a patent is sought on the invention entitled

An Acid Bath for the Electrodeposition of Glossy Gold and Gold Alloy Layers and a Gloss Additive for Same

(check one) ☐ is attached hereto.

- ■ was filed as U.S. Application No._____ on _____ and *(if applicable)* was amended on _____ and filed on _____.
- ■ was filed as PCT International Application No. PCT/EP00/03993 on May 4, 2000 and *(if applicable)* was amended under PCT Article 34 on _____.

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) or §365(b) of any foreign and PCT application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America listed in this Declaration. I have also identified below any foreign application for patent or inventor's certificate or PCT international application having a filing date before that of the application(s) on which priority is claimed:

Foreign/PCT Application No.	Country	Filing Date	Priority Claimed? (yes/no)
199 27 642.0	Germany	June 17, 1999	Yes
100 07 325.5	Germany	February 17, 2000	Yes

I hereby claim the benefit under Title 35, United States Code, §120 or §365(c) of any United States application and PCT international application designating the United States of America listed in this Declaration and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application or PCT international application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

U.S. Application No.	Filing Date	*Status (patented/pending/abandoned?)*

I hereby claim priority benefits under Title 35 United State s Code §119(e) of any U.S. provisional application(s) listed below:

U.S. Provisional Application No.	Filing Date

I hereby appoint the following attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: Robert G. Weilacher (20,531), Herbert M. Hanegan (25,682), Dale Lischer (28,438), Frederick F. Calvetti (28,557), J. Rodgers Lunsford, III (29,405), Michael A. Makuch (32,263), Dennis C. Rodgers (32,936), Mary A. Montebello (33,021), Michael K. Carrier (42,391), Eric J. Hanson (44,738), Patrick R. Delaney (45,338) Brandon S. Boss (46,567), and Brett L. Nelson (48,119). (13)

Send all correspondence to: SMITH, GAMBRELL & RUSSELL, LLP, 1850 M Street, N.W. (Suite 800), Washington, D.C. 20036. All facsimiles may be sent to (202) 263-4329. Direct all phone calls to (202) 659-2811.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1.00

Full name of sole or first inventor: Uwe Manz DEX Citizenship: Germany
Residence *(city, state, country)*: D-73431 Aalen, Germany
Post office address: Egerlandstrasse 17, D-73431 Aalen, Germany

Signature: Uwe Manz Date: 01/15/2001

2.00

Full name of second joint inventor, if any: Klaus Bronder DEX Citizenship: Germany
Residence *(city, state, country)*: D-73525 Schwäbisch Gmünd, Germany
Post office address: Im Fuggerle 28, D-73525 Schwäbisch Gmünd, Germany

Signature: Klaus Bronder Date: 01/15/2001